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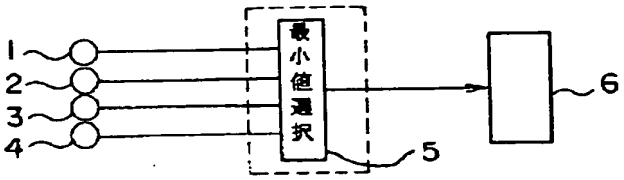
(54)【発明の名称】　燃料電池装置

(57)【要約】
【目的】ガス流量および負荷電流量が変動しても、燃料電池全平面内で燃料極のガス圧力が相対する酸化剤極のガス圧力を上回り、かつ差圧が最も小さい差圧制御を行なって、燃料電池の破損や、寿命低下を防止すること。
【構成】電解質を含浸した電解質層を挟んで燃料極および酸化剤極の一対の多孔質電極を対向配置して成り、燃料極に燃料ガス、酸化剤極に酸化剤ガスがそれぞれ流通している条件下で起こる電気化学的反応により、両電極間から電気エネルギーを出力する燃料電池において、燃料極および酸化剤極の両電極間の差圧を複数の地点で検出する複数の差圧検出手段と、各差圧検出手段によりそれぞれ検出された差圧検出値の中から最小値を選択し、この選択された最小値を両電極間の差圧として伝送する選択伝送手段と、選択伝送手段により伝送された最小値が設定値と等しくなるように両電極間の差圧を制御する差圧制御手段とを備える。



【特許請求の範囲】
【請求項１】 電解質を含浸した電解質層を挟んで燃料極および酸化剤極の一対の多孔質電極を対向配置して成り、前記燃料極に燃料ガスおよび前記酸化剤極に酸化剤ガスがそれぞれ流通している条件下で起こる電気化学的反応により、前記両電極間から電気エネルギーを出力する燃料電池において、
前記燃料極および酸化剤極の両電極間の差圧（ガス差圧）を複数の地点で検出する複数の差圧検出手段と、
前記各差圧検出手段によりそれぞれ検出された差圧検出値の中から最小値を選択し、当該選択された最小値を前記両電極間の差圧として伝送する選択伝送手段と、
前記選択伝送手段により伝送された最小値が設定値と等しくなるように前記両電極間の差圧を制御する差圧制御手段と、
を備えて成ることを特徴とする燃料電池装置。
【請求項２】 電解質を含浸した電解質層を挟んで燃料極および酸化剤極の一対の多孔質電極を対向配置して成り、前記燃料極に燃料ガスおよび前記酸化剤極に酸化剤ガスがそれぞれ流通している条件下で起こる電気化学的反応により、前記両電極間から電気エネルギーを出力する燃料電池において、
前記燃料極および酸化剤極の両電極間の差圧（ガス差圧）を任意の１地点で検出する差圧検出手段と、
前記燃料電池の出力電流を検出する電流検出手段と、
前記燃料極および酸化剤極に供給される燃料ガスおよび酸化剤ガスの流量をそれぞれ検出する流量検出手段と、
前記差圧検出手段により検出された差圧検出値、前記電流検出手段により検出された電流検出値、および前記各流量検出手段によりそれぞれ検出された流量検出値に基づいて、前記任意の検出地点以外の複数地点での各々の差圧を演算し、当該演算された差圧演算値を前記両電極間の差圧として出力する差圧演算手段と、
前記差圧検出手段により検出された差圧検出値、および前記差圧演算手段により出力された各差圧演算値の中から最小値を選択し、当該選択された最小値を前記両電極間の差圧として伝送する選択伝送手段と、
前記選択伝送手段により伝送された最小値が設定値と等しくなるように前記両電極間の差圧を制御する差圧制御手段と、
を備えて成ることを特徴とする燃料電池装置。
【発明の詳細な説明】
【０００１】
【産業上の利用分野】本発明は、差圧制御機能を備えた燃料電池装置に係り、特に燃料電池全平面内で燃料極のガス圧力が相対する酸化剤極のガス圧力を上回り、かつ差圧が最も小さい差圧制御が行なえるようにした燃料電池装置に関するものである。
【０００２】
【従来の技術】従来から、電解質を含浸した電解質層を挟んで燃料極および酸化剤極の一対の多孔質電極を対向配置して成り、燃料極に燃料ガスおよび酸化剤極に酸化剤ガスがそれぞれ流通している条件下で起こる電気化学的反応により、上記両電極間から電気エネルギーを出力するようにした燃料電池が用いられてきている。
【０００３】この種の燃料電池のうち、特に、電解質として酸性電解質を含浸した電解質層を挟んで燃料極および酸化剤極を対向配置して成る燃料電池においては、その高密度出力化を図る一手段として、電極、および電解質層を薄く、広くすることにより実現するようにしている。
【０００４】一般に、燃料極および酸化剤極の両電極間のガス差圧（以下、単に差圧と称する）は、この薄くなった電解質層の保護のため、最小となるように制御されるか、あるいは例えば“特公平３－１０５８６４号公報”に示されるように、腐食による燃料電池の寿命上の観点から、燃料極のガス圧力が酸化剤極のガス圧力よりもやや高めになるように設定されている。
【０００５】しかしながら、燃料極および酸化剤極の両電極間の差圧の検出は、燃料電池全平面内の固定の１地点で行なわれていることから、標準負荷時に対応した差圧制御に固定されている。
【０００６】前述のように、電極、および電解質層が広くなっているため、ガス流に対する圧損により、燃料電池全平面内の各地点における両電極間の差圧は、一様でなく違いが大きい。さらに、燃料電池は負荷応答性が高いことを期待されており、低ガス流量での低負荷量運転、高ガス流量での高負荷量運転等、標準負荷量以外の運転を行なうことも比較的多いことから、標準負荷時に対応した差圧制御のみでは、燃料電池全平面内の差圧検出地点や負荷量等によって、局所的に極端に差圧が大きくなったり、酸化剤極のガス圧力が燃料極のガス圧力を上回ることもある。その結果、燃料電池の破損や、寿命低下を生じることになる。
【０００７】
【発明が解決しようとする課題】以上のように、従来の燃料電池においては、ガス流量および負荷電流量が変動した場合に、燃料電池の破損や、寿命低下を生じるという問題があった。本発明の目的は、ガス流量および負荷電流量が変動しても、燃料電池全平面内で燃料極のガス圧力が相対する酸化剤極のガス圧力を上回り、かつ差圧が最も小さい差圧制御を行なって、燃料電池の破損や、寿命低下を防止することが可能な燃料電池装置を提供することにある。
【０００８】
【課題を解決するための手段】上記の目的を達成するために、電解質を含浸した電解質層を挟んで燃料極および酸化剤極の一対の多孔質電極を対向配置して成り、燃料極に燃料ガスおよび酸化剤極に酸化剤ガスがそれぞれ流通している条件下で起こる電気化学的反応により、上記

両電極間から電気エネルギーを出力する燃料電池において、まず、請求項１に対応する発明では、燃料極および酸化剤極の両電極間の差圧（ガス差圧）を複数の地点で検出する複数の差圧検出手段と、各差圧検出手段によりそれぞれ検出された差圧検出値の中から最小値を選択し、当該選択された最小値を両電極間の差圧として伝送する選択伝送手段と、選択伝送手段により伝送された最小値が設定値と等しくなるように両電極間の差圧を制御する差圧制御手段とを備えて成る。

【０００９】また、請求項２に対応する発明では、燃料極および酸化剤極の両電極間の差圧（ガス差圧）を任意の１地点で検出する差圧検出手段と、燃料電池の出力電流を検出する電流検出手段と、燃料極および酸化剤極に供給される燃料ガスおよび酸化剤ガスの流量をそれぞれ検出する流量検出手段と、差圧検出手段により検出された差圧検出値、電流検出手段により検出された電流検出値、および前記各流量検出手段によりそれぞれ検出された流量検出値に基づいて、上記任意の検出地点以外の複数地点での各々の差圧を演算し、当該演算された差圧演算値を両電極間の差圧として出力する差圧演算手段と、差圧検出手段により検出された差圧検出値、および差圧演算手段により出力された各差圧演算値の中から最小値を選択し、当該選択された最小値を両電極間の差圧として伝送する選択伝送手段と、選択伝送手段により伝送された最小値が設定値と等しくなるように両電極間の差圧を制御する差圧制御手段とを備えて成る。

【００１０】

【作用】従って、本発明の燃料電池装置においては、燃料電池全平面内の各地点の各差圧の中で、酸化剤極のガス圧力が相対する燃料極のガス圧力に対して最も高い値について差圧制御を行なうことにより、燃料電池全平面内で燃料極のガス圧力が相対する酸化剤極のガス圧力を上回り、かつ差圧が最も小さい差圧制御が得られることになる。これにより、燃料電池の破損や、寿命低下を防止することができる。

【００１１】

【実施例】以下、本発明の実施例について図面を参照して詳細に説明する。

（第１の実施例）図２は、本実施例による燃料電池装置における差圧検出系の構成例を示す部分斜視図である。

【００１２】図２において、酸性電解質を含浸した電解質層を挟んで燃料極および酸化剤極の一対の多孔質電極を対向配置して成る燃料電池１１は、その燃料極に燃料ガスを、また酸化剤極に酸化剤ガスをそれぞれ流通させて、当該条件下で起こる電気化学的反応により、上記両電極間から電気エネルギーを出力するようになっている。

【００１３】また、燃料電池１１全平面内の複数地点（本例では、４地点（４隅））には、燃料極および酸化剤極の両電極間の差圧を検出する差圧検出部１，２，３，４をそれぞれ設けている。

【００１４】図１は、本実施例による燃料電池装置における差圧制御系の構成例を示す機能ブロック図である。すなわち、本差圧制御系は、図１に示すように、上記４つの差圧検出部１，２，３，４と、選択伝送手段である最小値選択部５と、差圧制御部６とから成っている。

【００１５】ここで、最小値選択部５は、各差圧検出部１，２，３，４によりそれぞれ検出された差圧検出値を入力してその中から最小値を選択し（燃料極高を正とする）、この選択された最小値を上記両電極間の差圧として差圧制御部６へ伝送するものである。

【００１６】また、差圧制御部６は、最小値選択部５により伝送された最小値が設定値と等しくなるように、上記両電極間の差圧を制御するものである。次に、以上のように構成した本実施例の燃料電池装置の作用について説明する。

【００１７】燃料電池１１全平面内の４地点（４隅）で、燃料極および酸化剤極の両電極間の差圧が、差圧検出部１，２，３，４によりそれぞれ検出され、各差圧検出値は最小値選択部５に入力される。

【００１８】また、最小値選択部５では、入力された各差圧検出値の中から最小値が選択され（燃料極高を正とする）、この選択された最小値が両電極間の差圧（測定値）として差圧制御部６に伝送される。

【００１９】さらに、差圧制御部６では、伝送された最小値が設定値と等しくなるように、両電極間の差圧が制御される。以上のような動作が、連続的に順次繰り返される。そして、かかる制御により、差圧検出部１，２，３，４による差圧検出地点では、全地点が正（燃料極高）で最小値が設定値となる。

【００２０】これにより、ガス流量および負荷電流量が変動しても、燃料電池１１全平面内で燃料極のガス圧力が相対する酸化剤極のガス圧力を上回り、かつ差圧が最も小さい差圧制御が得られることになる。

【００２１】上述したように、本実施例の燃料電池装置は、燃料電池１１全平面内の４地点（４隅）で燃料極および酸化剤極の両電極間の差圧を検出する差圧検出部１，２，３，４と、各差圧検出部１，２，３，４によりそれぞれ検出された差圧検出値を入力してその中から最小値を選択し、この選択された最小値を両電極間の差圧として差圧制御部６へ伝送する最小値選択部５と、最小値選択部５により伝送された最小値が設定値と等しくなるように、両電極間の差圧を制御する差圧制御部６とを設けるようにしたものである。

【００２２】従って、ガス流量および負荷電流量が変動しても、燃料電池１１全平面内で燃料極のガス圧力が相対する酸化剤極のガス圧力を上回り、かつ差圧が最も小さい差圧制御を行なって、燃料電池１１の破損や、寿命低下を防止することが可能となる。

【００２３】（第２の実施例）図３は、本実施例による

燃料電池装置における差圧制御系の構成例を示す機能ブロック図であり、図１と同一要素には同一符号を付して示している。

【００２４】すなわち、本差圧制御系は、図３に示すように、前記差圧検出部１（差圧検出部２，３，４のいずれか１つであってもよい）と、電流検出部７と、燃料極側の流量検出部８と、酸化剤極側の流量検出部９と、差圧演算部１０と、最小値選択部５と、差圧制御部６とから成っている。なお、差圧演算部１０、および最小値選択部５により、演算伝送手段を構成している。

【００２５】ここで、電流検出部７は、前記燃料電池１１の出力電流を検出するものである。また、流量検出部８は、燃料電池１１の燃料極に供給される燃料ガスの流量を検出するものである。

【００２６】さらに、流量検出部９は、燃料電池１１の酸化剤極に供給される酸化剤ガスの流量を検出するものである。一方、差圧演算部１０は、差圧検出部１により検出された差圧検出値、電流検出部７により検出された電流検出値、および各流量検出部８，９によりそれぞれ検出された流量検出値に基づいて、上記任意の検出地点（本例では、差圧検出部１の設置点）以外の複数地点（本例では、前記差圧検出部２，３，４の設置点）での各々の差圧を演算し、この演算された差圧演算値を両電極間の差圧として出力するものである。

【００２７】また、最小値選択部５は、差圧検出部１により検出された差圧検出値、および差圧演算部１０により出力された各差圧演算値を入力してその中から最小値を選択し（燃料極高を正とする）、この選択された最小値を上記両電極間の差圧として差圧制御部６へ伝送するものである。

【００２８】さらに、差圧制御部６は、最小値選択部５により伝送された最小値が設定値と等しくなるように、上記両電極間の差圧を制御するものである。次に、以上のように構成した本実施例の燃料電池装置の作用について説明する。

【００２９】燃料電池１１全平面内の任意の１地点で、燃料極および酸化剤極の両電極間の差圧が、差圧検出部１により検出され、その差圧検出値は差圧演算部１０に入力される。

【００３０】一方、燃料電池１１の出力電流が、電流検出部７により検出され、その電流検出値は差圧演算部１０に入力される。また、燃料電池１１の燃料極に供給される燃料ガスの流量が、流量検出部８により検出され、その流量検出値は差圧演算部１０に入力される。

【００３１】さらに、燃料電池１１の酸化剤極に供給される酸化剤ガスの流量が、流量検出部９により検出され、その流量検出値は差圧演算部１０に入力される。一方、差圧演算部１０では、入力された差圧検出値、電流検出値、および各流量検出値から、上記任意の検出地点（差圧検出部１の設置点）以外の複数地点（圧検出部２，３，４の設置点）での各々の差圧が演算され、その差圧演算値が両電極間の差圧として、差圧検出部１からの差圧検出値と共に、最小値選択部５に入力される。

【００３２】また、最小値選択部５では、入力された差圧検出値、および各差圧演算値の中から最小値が選択され（燃料極高を正とする）、この選択された最小値が両電極間の差圧（測定値）として差圧制御部６に伝送される。

【００３３】さらに、差圧制御部６では、伝送された最小値が設定値と等しくなるように、両電極間の差圧が制御される。以上のような動作が、連続的に順次繰り返される。そして、かかる制御により、差圧検出部１，２，３，４の設置点に相当する差圧検出地点では、全地点が正（燃料極高）で最小値が設定値となる。

【００３４】これにより、ガス流量および負荷電流量が変動しても、燃料電池１１全平面内で燃料極のガス圧力が相対する酸化剤極のガス圧力を上回り、かつ差圧が最も小さい差圧制御が得られることになる。

【００３５】上述したように、本実施例の燃料電池装置は、燃料電池１１全平面内の任意の１地点で燃料極および酸化剤極の両電極間の差圧を検出する１台の差圧検出部１と、燃料電池１１の出力電流を検出する電流検出部７と、燃料電池１１の燃料極に供給される燃料ガスの流量を検出する流量検出部８と、燃料電池１１の酸化剤極に供給される酸化剤ガスの流量を検出する流量検出部９と、差圧検出部１により検出された差圧検出値、電流検出部７により検出された電流検出値、および各流量検出部８，９によりそれぞれ検出された流量検出値に基づいて、上記任意の検出地点（差圧検出部１の設置点）以外の複数地点（差圧検出部２，３，４の設置点）での各々の差圧を演算し、この演算された差圧演算値を両電極間の差圧として出力する差圧演算部１０と、差圧検出部１により検出された差圧検出値、および差圧演算部１０により出力された各差圧演算値を入力してその中から最小値を選択し（燃料極高を正とする）、この選択された最小値を上記両電極間の差圧として差圧制御部６へ伝送する最小値選択部５と、最小値選択部５により伝送された最小値が設定値と等しくなるように、上記両電極間の差圧を制御する差圧制御部６とを設けるようにしたものである。

【００３６】従って、前記第１の実施例の場合と同様に、ガス流量および負荷電流量が変動しても、燃料電池１１全平面内で燃料極のガス圧力が相対する酸化剤極のガス圧力を上回り、かつ差圧が最も小さい差圧制御を行なって、燃料電池１１の破損や、寿命低下を防止することが可能となる。

【００３７】尚、本発明は上記各実施例に限定されるものではなく、次のようにしても同様に実施できるものである。

（ａ）上記各実施例では、酸性電解質を含浸した電解質

層を挟んで燃料極および酸化剤極の一対の多孔質電極を対向配置して成る燃料電池に本発明を適用する場合について説明したが、これに限らず、アルカリ性電解質を含浸した電解質層を挟んで燃料極および酸化剤極の一対の多孔質電極を対向配置して成る燃料電池についても、本発明を同様に適用して前述の場合と同様の効果が得られるものである。

【００３８】なお、この場合には、燃料極と酸化剤極とを逆転させることにより、そのまま適用することができる。

（ｂ）上記各実施例では、燃料電池１１全平面内の４地点における燃料極および酸化剤極の両電極間の差圧に基づいて、差圧制御を行なう場合について説明したが、何らこれに限られないことは言うまでもない。

【００３９】

【発明の効果】以上説明したように、電解質を含浸した電解質層を挟んで燃料極および酸化剤極の一対の多孔質電極を対向配置して成り、燃料極に燃料ガスおよび酸化剤極に酸化剤ガスがそれぞれ流通している条件下で起こる電気化学的反応により、上記両電極間から電気エネルギーを出力する燃料電池において、まず、請求項１に対応する発明によれば、燃料極および酸化剤極の両電極間の差圧（ガス差圧）を複数の地点で検出する複数の差圧検出手段と、各差圧検出手段によりそれぞれ検出された差圧検出値の中から最小値を選択し、当該選択された最小値を両電極間の差圧として伝送する選択伝送手段と、選択伝送手段により伝送された最小値が設定値と等しくなるように両電極間の差圧を制御する差圧制御手段とを備えるようにしたので、ガス流量および負荷電流量が変動しても、燃料電池全平面内で燃料極のガス圧力が相対する酸化剤極のガス圧力を上回り、かつ差圧が最も小さい差圧制御を行なって、燃料電池の破損や、寿命低下を防止することが可能な燃料電池装置が提供できる。

【００４０】また、請求項２に対応する発明によれば、燃料極および酸化剤極の両電極間の差圧（ガス差圧）を任意の１地点で検出する差圧検出手段と、燃料電池の出力電流を検出する電流検出手段と、燃料極および酸化剤極に供給される燃料ガスおよび酸化剤ガスの流量をそれぞれ検出する流量検出手段と、差圧検出手段により検出された差圧検出値、電流検出手段により検出された電流検出値、および前記各流量検出手段によりそれぞれ検出された流量検出値に基づいて、上記任意の検出地点以外の複数地点での各々の差圧を演算し、当該演算された差圧演算値を両電極間の差圧として出力する差圧演算手段と、差圧検出手段により検出された差圧検出値、および差圧演算手段により出力された各差圧演算値の中から最小値を選択し、当該選択された最小値を両電極間の差圧として伝送する選択伝送手段と、選択伝送手段により伝送された最小値が設定値と等しくなるように両電極間の差圧を制御する差圧制御手段とを備えるようにしたので、ガス流量および負荷電流量が変動しても、燃料電池全平面内で燃料極のガス圧力が相対する酸化剤極のガス圧力を上回り、かつ差圧が最も小さい差圧制御を行なって、燃料電池の破損や、寿命低下を防止することが可能な燃料電池装置が提供できる。

【図面の簡単な説明】

【図１】本発明による第１の実施例の燃料電池装置における差圧検出系の構成例を示す部分斜視図。

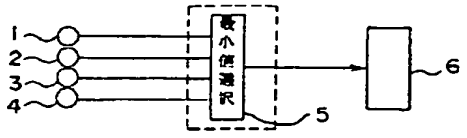
【図２】同第１の実施例の燃料電池装置における差圧制御系の構成例を示す機能ブロック図。

【図３】本発明による第２の実施例の燃料電池装置における差圧制御系の構成例を示す機能ブロック図。

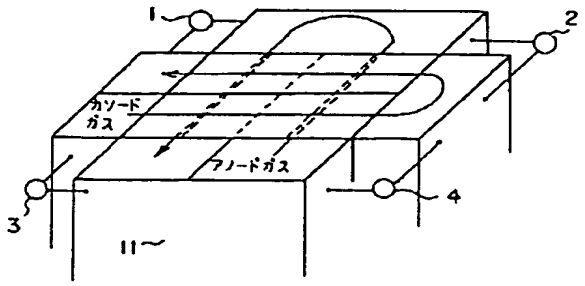
【符号の説明】

１，２，３，４…差圧検出部、
５…最小値選択部、
６…差圧制御部、
７…電流検出部、
８…燃料極側の流量検出部、
９…酸化剤極側の流量検出部、
１０…差圧演算部、
１１…燃料電池。

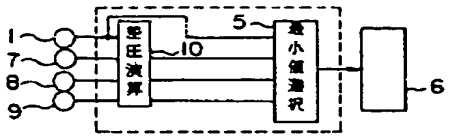
【図１】



【図２】



【図３】



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Bibliography.

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Summary.

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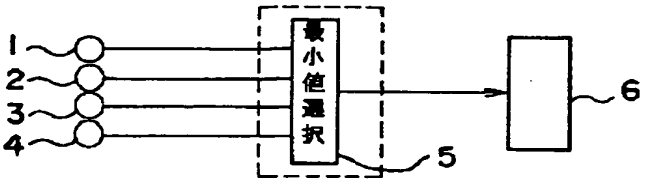
(57) [Abstract]
[Objects of the Invention] Even if you change a quantity of gas flow and the amount of load currents, exceed the gas pressure of the oxidizer pole which the gas pressure of a fuel electrode faces within [all fuel cell] a flat surface, and differential pressure should perform smallest differential pressure control, and prevent breakage of a fuel cell, and a life fall.
[Elements of the Invention] The fuel cell which outputs electrical energy equips with and constitutes the following from between two electrodes by the electrochemical reaction which occurs under the conditions to which opposite arrangement of the porous electrode of the couple of a fuel electrode and an oxidizer pole is carried out, it changes on both sides of the electrolyte layer which sank in the electrolyte, and oxidizer gas is circulating to the fuel electrode on fuel gas and the oxidizer pole, respectively. Two or more differential pressure detection meanses to detect the differential pressure between the two electrodes of a fuel electrode and an oxidizer pole at two or more points. A selection transmission means to choose the minimum value from the differential pressure detection values detected by each differential pressure detection means, respectively, and to transmit this selected minimum value as differential pressure between two electrodes. Differential pressure control means which control the differential pressure between two electrodes so that the minimum value transmitted by th selection transmission means becomes equal to the set point.

[Translation done.]



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CLAIMS

[Claim(s)]
[Claim 1] The fuel cell which outputs electrical energy from between the aforementioned two electrodes by the electrochemical reaction which occurs under the conditions to which opposite arrangement of the porous electrode of the couple of a fuel electrode and an oxidizer pole is

carried out, it changes on both sides of the electrolyte layer which is charact riz d by providing the following, and which sank in the electrolyte, and oxidizer gas is circulating to the aforementioned fuel electrode on fuel gas and the aforementioned oxidizer pole, respectively. Two or more differential pressure detection meanses to detect the differential pressure between the two electrodes of the aforementioned fuel electrode and an oxidizer pole (gas differ ntial pressure) at two or more points. A selection transmission means to choose the minimum value from the differential pressure detection values detected by each aforementioned differential pressure detection means, respectively, and to transmit the selected minimum value concerned as differential pressure between the aforementioned two electrodes, and differential pressure control means which control the differential pressure between the aforementioned two electrodes so that the minimum value transmitted by the aforementioned selection transmission means becomes equal to the set point.

[Claim 2] The fuel cell which outputs electrical energy from between the aforementioned two electrodes by the electrochemical reaction which occurs under the conditions to which opposite arrangement of the porous electrode of the couple of a fuel electrode and an oxidizer pole is carried out, it changes on both sides of the electrolyte layer which is characterized by providing the following, and which sank in the electrolyte, and oxidizer gas is circulating to the aforementioned fuel electrode on fuel gas and the aforementioned oxidizer pole, respectively. A differential pressure detection means to detect the differential pressure between the two electrodes of the aforementioned fuel electrode and an oxidizer pole (gas differential pressure) at one arbitrary point. A current detection means to detect the output current of the aforementioned fuel cell. A flow rate detection means to detect the flow rate of the fuel gas supplied to the aforementioned fuel electrode and an oxidizer pole, and oxidizer gas, respectively. The differential pressure detection value detected by the aforementioned differential pressure detection means, the current detection value detected by the aforementioned current detection means, And a differential pressure operation means to calculate each differential pressure in two or more points other than the detection point of the aforementioned arbitration, and to output the calculated differential pressure operation value concerned as differential pressure between the aforementioned two electrodes based on the flow rate detection value detected by each aforementioned flow rate detection means, respectively, A selection transmission means to choose the minimum value from the differential pressure detection value detected by the aforementioned differential pressure detection means, and each differential pressure operation value outputted by the aforementioned differential pressure operation means, and to transmit the selected minimum value concerned as differential pressure between the aforementioned two electrodes, Differential pressure control means which control the differential pressure between the aforementioned two electrodes so that the minimum value transmitted by the aforementioned selection transmission means becomes equal to the set point.

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DETAILED DESCRIPTION

[Detailed Description of th Invention]
[0001]
[Industrial Application] this invention relates to the fuel cell equipment which exceeds the gas pressure of the oxidizer pole which fuel cell equipment equipped with the differential pressure control function is started, especially the gas pressure of a fuel electrod faces within [all fuel cell] a flat surface, and enabled it to perform differential pressure control with the smallest differential pressure.
[0002]
[Description of the Prior Art] On both sides of the electrolyte layer which sank in the electrolyte, opposite arrangement of the porous electrode of the couple of a fuel electrode and an oxidizer pole is carried out, it consists of the former, and the fuel cell it was made to output electrical energy from between the above-mentioned two electrodes has been used by the electrochemical reaction which occurs under the conditions to which oxidizer gas is circulating to the fuel electrode on fuel gas and the oxidizer pole, respectively.
[0003] In the fuel cell which carries out opposite arrangement of a fuel electrode and the oxidizer pole, and changes on both sides of the electrolyte layer which sank in the acid electrolyte as an electrolyte especially among this kind of fuel cells, it is made to realize by being thin and making an electrode and an electrolyte layer large as a way stage which attains the high-density output-ization.
[0004] Generally, for protection of this electrolyte layer that became thin, as it is controlled to become the minimum or is shown in "JP,3-105864,B", the gas differential pressure between the two electrodes of a fuel electrode and an oxidizer pole (differential pressure is only called hereafter) is set up from a viewpoint on the life of the fuel cell by corrosion, so that the gas pressure of a fuel electrode may consist mist and height of gas pressure of an oxidizer pole.
[0005] However, since detection of the differential pressure between the two electrodes of a fuel electrode and an oxidizer pole is performed at one point of fixation in [all fuel cell] a flat surface, it is fixed to the differential pressure control corresponding to the time of a standard load.
[0006] As mentioned above, since the electrode and the electrolyte layer are large, the differential pressure between two electrodes [in / the every place point in / all fuel cell / a flat surface / by the pressure loss to a gas stream] has a great not being uniform difference. It is expected that load responsibility of a fuel cell is high. Furthermore, low burden operation by the low quantity of gas flow, Since operations of those other than the amount of standard loads, such as the amount operation of heavy loads by the high quantity of gas flow, are performed in comparatively many cases, only by the differential pressure control corresponding to the time of a standard load By a differential pressure detection point, a burden, etc. in [all fuel cell] a flat surface, differential pressure may become large extremely locally, or the gas pressure of an oxidizer pole may exceed the gas pressure of a fuel electrode. Consequently, breakage of a fuel cell and a life fall will be produced.
[0007]
[Problem(s) to be Solved by the Invention] As mentioned above, in the conventional fuel cell, when a quantity of gas flow and the amount of load currents were changed, there were breakage of a fuel cell and a problem of producing a life fall. The purpose of this invention is to exceed the gas pressure of the oxidizer pole which the gas pressure of a fuel electrode faces within [all fuel cell] a flat surface, and for differential pressure perform smallest differential pressure control, and offer breakage of a fuel cell, and the fuel cell equipment which can prevent a life fall, even if it changes a quantity of gas flow and the amount of load currents.
[0008]
[Means for Solving the Problem] In order to attain th above-mentioned purpose, on both sides of the electrolyte layer which sank in the electrolyte, carry out opposite arrangement of the porous electrode of the couple of a fuel electrode and an oxidizer pole, and it changes. By the electrochemical reaction from which oxidizer gas happens to a fuel electrode under the conditions which are circulating, respectively on fuel gas and the oxidizer pole In the fuel cell which outputs electrical energy from between the above-mentioned two electrodes, by invention

corresponding to a claim 1 first Two or more differential pressure detection meanses to detect the differential pressure between the two electrodes of a fuel electrode and an oxidizer p le (gas differential pressure) at two or more points, A selection transmission means to choose the minimum value from the differential pressure detection values detected by each differential pressure detection means, respectively, and to transmit the selected minimum value conc rned as differential pressure between two electrodes, It has the differential pressure control means which control the differential pressure between two electrodes so that the minimum value transmitted by the selection transmission means becomes equal to the set point, and changes.
[0009] Moreover, a differential pressure detection means to detect the differential pressure between the two electrodes of a fuel electrode and an oxidizer pole (gas differential pressure) in invention corresponding to a claim 2 at one arbitrary point, A current detection means to detect the output current of a fuel cell, and a flow rate detection means to detect the flow rate of the fuel gas supplied to a fuel electrode and an oxidizer pole, and oxidizer gas, respectively, The differential pressure detection value detected by the differential pressure detection means, the current detection value detected by the current detection means, And a differential pressure operation means to calculate each differential pressure in two or more points other than the detection point of the above-mentioned arbitration, and to output the calculated differential pressure operation value concerned as differential pressure between two electrodes based on the flow rate detection value detected by each aforementioned flow rate detection means, respectively, A selection transmission means to choose the minimum value from the differential pressure detection value detected by the differential pressure detection means, and each differential pressure operation value outputted by the differential pressure operation means, and to transmit the selected minimum value concerned as differential pressure between two electrodes, It has the differential pressure control means which control the differential pressure between two electrodes so that the minimum value transmitted by the selection transmission means becomes equal to the set point, and changes.
[0010]
[Function] Therefore, in the fuel cell equipment of this invention, by performing differential pressure control about the highest value to the gas pressure of the fuel electrode which the gas pressure of an oxidizer pole faces in each differential pressure of the every place point in [all fuel cell] a flat surface, it will exceed the gas pressure of the oxidizer pole which the gas pressure of a fuel electrode faces within [all fuel cell] a flat surface, and the differential pressure control with the smallest differential pressure will be obtained. Thereby, breakage of a fuel cell and a life fall can be prevented.
[0011]
[Example] Hereafter, the example of this invention is explained in detail with reference to a drawing.
(The 1st example) Drawing 2 is the partial perspective diagram showing the example of composition of the differential pressure detection system in the fuel cell equipment by this example.
[0012] The fuel cell 11 which carries out opposite arrangement of the porous electrode of the couple of a fuel electrode and an oxidizer pole, and changes in drawing 2 on both sides of the electrolyte layer which sank in the acid electrolyte circulates fuel gas to the fuel electrode, and circulates oxidizer gas to the oxidizer pole, respectively, and electrical energy is outputted from between the above-mentioned two electrodes by the electrochemical reaction which occurs under the conditions concerned.
[0013] Moreover, the differential pressure detecting elements 1, 2, 3, and 4 which detect the differential pressure between the two electrodes of a fuel electrode and an oxidizer pole are formed in two or more points in [fuel cell 11 all] a flat surface (this example four points (four corners)), respectively.
[0014] Drawing 1 is the functional block diagram showing the example of composition of the differential pressure control system in the fuel cell equipment by this example. That is, this differential pressure control system consists of the four above-mentioned differential pressure detecting elements 1, 2, 3, and 4, the lowest-selection section 5 which is a selection

transmission means, and th differential pressure control section 6, as shown in drawing 1 .
[0015] Here, the lowest-selection section 5 inputs the differential pressure detection valu detected by each differential pressure detecting elements 1, 2, 3, and 4, respectively, chooses the minimum value from the inside (fuel-electrode quantity is made positive), and transmits this selected minimum value to the differential pressure control section 6 as differential pressure between the above-mentioned two electrodes.
[0016] Moreover, the differential pressure control section 6 controls the differential pressure between the above-mentioned two electrodes so that the minimum value transmitted by the lowest-selection section 5 becomes equal to the set point. Next, an operation of the fuel cell equipment of this example constituted as mentioned above is explained.
[0017] The differential pressure between the two electrodes of a fuel electrode and an oxidizer pole is detected by the differential pressure detecting elements 1, 2, 3, and 4, respectively, and each differential pressure detection value is inputted into the lowest-selection section 5 at four points in [fuel cell 11 all] a flat surface (four corners).
[0018] Moreover, in the lowest-selection section 5, the minimum value is chosen from each inputted differential pressure detection values (fuel-electrode quantity is made positive), and this selected minimum value is transmitted to the differential pressure control section 6 as differential pressure between two electrodes (measured value).
[0019] Furthermore, the differential pressure between two electrodes is controlled by the differential pressure control section 6 so that the transmitted minimum value becomes equal to the set point. The above operation is repeated successively continuously. And the minimum value turns into [all points] the set point by positive (fuel-electrode quantity) by this control at the differential pressure detection point by the differential pressure detecting elements 1, 2, 3, and 4.
[0020] By this, even if it changes a quantity of gas flow and the amount of load currents, it will exceed the gas pressure of the oxidizer pole which the gas pressure of a fuel electrode faces within [fuel cell 11 all] a flat surface, and the differential pressure control with the smallest differential pressure will be obtained.
[0021] As mentioned above, the fuel cell equipment of this example The differential pressure detecting elements 1, 2, 3, and 4 which detect the differential pressure between the two electrodes of a fuel electrode and an oxidizer pole at four points in [fuel cell 11 all] a flat surface (four corners), The lowest-selection section 5 which inputs the differential pressure detection value detected by each differential pressure detecting elements 1, 2, 3, and 4, respectively, chooses the minimum value from the inside, and transmits this selected minimum value to the differential pressure control section 6 as differential pressure between two electrodes, The differential pressure control section 6 which controls the differential pressure between two electrodes is formed so that the minimum value transmitted by the lowest-selection section 5 may become equal to the set point.
[0022] Therefore, even if it changes a quantity of gas flow and the amount of load currents, it exceeds the gas pressure of the oxidizer pole which the gas pressure of a fuel electrode faces within [fuel cell 11 all] a flat surface, and differential pressure performs smallest differential pressure control, and it becomes possible breakage of a fuel cell 11, and to prevent a life fall.
[0023] (The 2nd example) Drawing 3 is the functional block diagram showing the example of composition of the differential pressure control system in the fuel cell equipment by this example, and attaches and shows the same sign to the same element as drawing 1 .
[0024] That is, this differential pressure control system consists of the aforementioned differential pressure detecting element 1 (you may be any one of the differential pressure detecting elements 2, 3, and 4), the current detecting element 7, the flow rate detecting element 8 by the side of a fuel electrode, the flow rate detecting element 9 by the side of an oxidizer pole, the differential pressure operation part 10, the lowest-selection section 5, and the differential pressure control section 6, as shown in drawing 3 . In addition, the differential pressure operation part 10 and the lowest-selection section 5 constitute the operation transmission means.
[0025] Here, the current detecting element 7 detects the output current of the aforementioned

fuel cell 11. Moreover, the flow rate detecting element 8 detects the flow rate of the fuel gas supplied to the fuel electrode of a fuel cell 11.
[0026] Furthermore, the flow rate detecting element 9 detects the flow rate of the oxidizer gas supplied to the oxidizer pole of a fuel cell 11. The differential pressur detection value with which the differential pressure operation part 10 was detected by the differential pressure detecting element 1 on the other hand, It is based on the current detection value detected by the current detecting element 7, and the flow rate detection value detected by each flow rate detecting elements 8 and 9, respectively, and is the detection point (in this example) of the above-mentioned arbitration. Each differential pressure in two or more points other than the installing point of the differential pressure detecting element 1 (this example installing point of the aforementioned differential pressure detecting elements 2, 3, and 4) is calculated, and this calculated differential pressure operation value is outputted as differential pressure between two electrodes.
[0027] Moreover, the lowest-selection section 5 inputs the differential pressure detection value detected by the differential pressure detecting element 1, and each differential pressure operation value outputted by the differential pressure operation part 10, chooses the minimum value from the inside (fuel-electrode quantity is made positive), and transmits this selected minimum value to the differential pressure control section 6 as differential pressure between the above-mentioned two electrodes.
[0028] Furthermore, the differential pressure control section 6 controls the differential pressur between the above-mentioned two electrodes so that the minimum value transmitted by the lowest-selection section 5 becomes equal to the set point. Next, an operation of the fuel cell equipment of this example constituted as mentioned above is explained.
[0029] The differential pressure between the two electrodes of a fuel electrode and an oxidizer pole is detected by the differential pressure detecting element 1, and the differential pressure detection value is inputted into the differential pressure operation part 10 at one arbitrary point in [fuel cell 11 all] a flat surface.
[0030] On the other hand, the output current of a fuel cell 11 is detected by the current detecting element 7, and the current detection value is inputted into the differential pressure operation part 10. Moreover, the flow rate of the fuel gas supplied to the fuel electrode of a fuel cell 11 is detected by the flow rate detecting element 8, and the flow rate detection value is inputted into the differential pressure operation part 10.
[0031] Furthermore, the flow rate of the oxidizer gas supplied to the oxidizer pole of a fuel cell 11 is detected by the flow rate detecting element 9, and the flow rate detection value is inputted into the differential pressure operation part 10. On the other hand, in the differential pressure operation part 10, from the inputted differential pressure detection value, a current detection value, and each flow rate detection value, each differential pressure in two or more points (installing point of ******** 2, 3, and 4) other than the detection point (installing point of the differential pressure detecting element 1) of the above-mentioned arbitration calculates, and the differential pressure operation value is inputted into the lowest-selection section 5 as differential pressure between two electrodes with the differential pressure detection value from the differential pressure detecting element 1.
[0032] Moreover, in the lowest-selection section 5, the minimum value is chosen from the inputted differential pressure detection value and each differential pressure operation value (fuel-electrode quantity is made positive), and this selected minimum value is transmitted to the differential pressure control section 6 as differential pressure between two electrodes (measured value).
[0033] Furthermore, the differential pressure between two electrodes is controlled by the differential pressure control section 6 so that the transmitted minimum value becomes equal to the set point. The above operation is repeated successively continuously. And the minimum value turns into [all points] the set point by positive (fuel-electrode quantity) by this control at the differential pressure detection point equivalent to the installing point of the differential pressure detecting elements 1, 2, 3, and 4.
[0034] By this, even if it changes a quantity of gas flow and the amount of load currents, it will

exceed the gas pressure of the oxidizer pole which the gas pressur f a fuel el ctrode faces within [fuel cell 11 all] a flat surface, and the differential pressure control with th smallest differential pressure will be obtained.

[0035] As mentioned above, the fuel cell equipment of this example On set of the differential pressure detecting element 1 which detects the differential pressur between the two electrodes of a fuel electrode and an oxidizer pol at one arbitrary point in [fuel cell 11 all] a flat surface The current detecting element 7 which detects the output current of a fuel cell 11, and the flow rate detecting element 8 which detects the flow rate of the fuel gas supplied to th fuel electrode of a fuel cell 11, The flow rate detecting element 9 which detects the flow rate of the oxidizer gas supplied to the oxidizer pole of a fuel cell 11, The differential pressure detection value detected by the differential pressure detecting element 1, the current detection value detected by the current detecting element 7, And it is based on the flow rate detection value detected by each flow rate detecting elements 8 and 9, respectively. The differential pressure operation part 10 which calculates each differential pressure in two or more points (installing point of the differential pressure detecting elements 2, 3, and 4) other than the detection point (installing point of the differential pressure detecting element 1) of the above-mentioned arbitration, and outputs this calculated differential pressure operation value as differential pressure between two electrodes, Input the differential pressure detection value detected by the differential pressure detecting element 1, and each differential pressure operation value outputted by the differential pressure operation part 10, and the minimum value is chosen from the inside (fuel-electrode quantity is made positive). The lowest-selection section 5 which transmits this selected minimum value to the differential pressure control section 6 as differential pressure between the above-mentioned two electrodes, and the differential pressure control section 6 which controls the differential pressure between the above-mentioned two electrodes so that the minimum value transmitted by the lowest-selection section 5 becomes equal to the set point are formed.

[0036] Therefore, like the case of the 1st example of the above, even if it changes a quantity of gas flow and the amount of load currents, it exceeds the gas pressure of the oxidizer pole which the gas pressure of a fuel electrode faces within [fuel cell 11 all] a flat surface, and differential pressure performs smallest differential pressure control, and it becomes possible breakage of a fuel cell 11, and to prevent a life fall.

[0037] In addition, this invention is not limited to each above-mentioned example, and even if it performs it as follows, it can be carried out similarly.

(a) Although each above-mentioned example explained the case where this invention was applied to the fuel cell which carries out opposite arrangement of the porous electrode of the couple of a fuel electrode and an oxidizer pole, and changes on both sides of the electrolyte layer which sank in the acid electrolyte Similarly with the application of this invention, the same effect as the above-mentioned case is acquired also about the fuel cell which carries out opposite arrangement of the porous electrode of the couple of a fuel electrode and an oxidizer pole, and changes on both sides of the electrolyte layer which sank in not only this but the alkaline electrolyte.

[0038] In addition, it is applicable as it is by reversing a fuel electrode and an oxidizer pole in this case.

(b) Although each above-mentioned example explained the case where differential pressure control was performed, based on the differential pressure between the two electrodes of the fuel electrode in four points in [fuel cell 11 all] a flat surface, and an oxidizer pole, not being restricted to this at all cannot be overemphasized.

[0039]

[Effect of the Invention] As explained above, on both sides of the electrolyte lay r which sank in the electrolyte, carry out opposite arrangement of the porous electrode of the couple of a fuel electrode and an oxidizer pole, and it changes. By th electrochemical reaction from which oxidizer gas happens to a fuel electrode under the conditions which are circulating, respectively on fuel gas and the oxidizer pole According to invention corresponding to a claim 1, in the fuel cell which outputs electrical energy from between the above-mentioned two electrodes, first

Two or more differential pressure detection meanses to detect the differential pressure between the two electrodes of a fuel electrode and an oxidizer pole (gas differential pressure) at two or more points, A selection transmission means to choose the minimum value from the differential pressure detection values detected by each differential pressure detection means, respectively, and to transmit the selected minimum value concerned as differential pressure between two electrodes, Since it had the differential pressure control means which control the differ ntial pressure between two electrodes so that the minimum value transmitted by the selection transmission means might become equal to the set point Even if it changes a quantity of gas flow and the amount of load currents, it exceeds the gas pressure of the oxidizer pole which the gas pressure of a fuel electrode faces within [all fuel cell] a flat surface, and differential pressure performs smallest differential pressure control, and breakage of a fuel cell and the fuel cell equipment which can prevent a life fall can be offered.
[0040] Moreover, a differential pressure detection means to detect the differential pressure between the two electrodes of a fuel electrode and an oxidizer pole (gas differential pressure) at one arbitrary point according to invention corresponding to a claim 2, A current detection means to detect the output current of a fuel cell, and a flow rate detection means to detect the flow rate of the fuel gas supplied to a fuel electrode and an oxidizer pole, and oxidizer gas, respectively, The differential pressure detection value detected by the differential pressure detection means, the current detection value detected by the current detection means, And a differential pressure operation means to calculate each differential pressure in two or more points other than the detection point of the above-mentioned arbitration, and to output the calculated differential pressure operation value concerned as differential pressure between two electrodes based on the flow rate detection value detected by each aforementioned flow rate detection means, respectively, A selection transmission means to choose the minimum value from the differential pressure detection value detected by the differential pressure detection means, and each differential pressure operation value outputted by the differential pressure operation means, and to transmit the selected minimum value concerned as differential pressure between two electrodes, Since it had the differential pressure control means which control the differential pressure between two electrodes so that the minimum value transmitted by the selection transmission means might become equal to the set point Even if it changes a quantity of gas flow and the amount of load currents, it exceeds the gas pressure of the oxidizer pole which the gas pressure of a fuel electrode faces within [all fuel cell] a flat surface, and differential pressure performs smallest differential pressure control, and breakage of a fuel cell and the fuel cell equipment which can prevent a life fall can be offered.

[Translation done.]

* NOTICES *

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The partial perspective diagram showing the example of composition of the differential pressure detection system in the fuel cell equipment of the 1st example by this

invention.
[Drawing 2] The functional block diagram showing the example of composition of the differential pressure control system in the fuel cell equipment of this 1st example.
[Drawing 3] The functional block diagram showing the example of composition of th diff rential pressure control system in the fuel cell equipment of the 2nd example by this invention.
[Description of Notations]
1, 2, 3, 4 — Differential pressure detecting element,
5 — Lowest-selection section,
6 — Differential pressure control section,
7 — Current detecting element,
8 — Flow rate detecting element by the side of a fuel electrode,
9 — Flow rate detecting element by the side of an oxidizer pole,
10 — Differential pressure operation part,
11 — Fuel cell.

[Translation done.]

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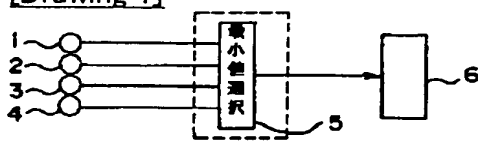
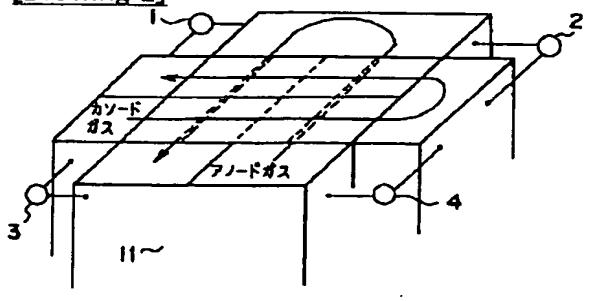
DRAWINGS

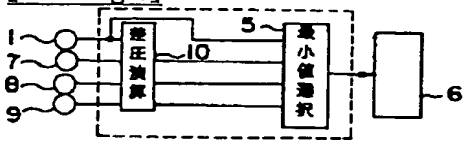
[Drawing 1]



[Drawing 2]



[Drawing 3]



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